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STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER

KNAPP, JUSTIN R

ART UNIT

PAPER NUMBER

2182

DATE MAILED: 09/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/533,042

Applicant(s)

SUNAYAMA ET AL.

Examiner

Justin Knapp

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 June 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Papers Submitted

1. It is hereby acknowledged that the following papers have been received and placed of record in the file: Extension of time as received 06/24/03.

Claim Objections

2. Claims 1, 4, 14, 15, 16, 17, and 18 are objected to because of the following informalities:
 - a) at the end of each claim, it states, "wherein the predicted branch is the branch of the instruction equivalent to the subroutine return in an architecture for which a particular instruction for a subroutine is not prepared". Examiner believes the word, -- return -- should be inserted between "subroutine" and "is not prepared". Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Losq, "Subroutine Return Address Stack", IBM Technical Disclosure Bulletin, December 1981.
5. Referring to claims 1 and 16, Losq has taught:
 - a) a storing circuit storing information specifying a return address of a subroutine when an instruction equivalent to a subroutine call is detected. On page 1, lines 26-27 and page 2, lines 1-

8, Losq has taught a storing circuit consisting of a Branch History Table and Subroutine Return Address Stack storing information specifying a return address of a subroutine when a call is detected.

b) a comparing circuit making a comparison between information specifying a branch destination address of an instruction which can possibly be an instruction equivalent to a subroutine return and the information specifying the return address stored in said storing circuit, and outputting a result of the comparison, when the instruction which can possibly be the instruction equivalent to the subroutine return is detected. On page 2, lines 40-46, Losq has taught a decoder used as comparing circuitry to compare R1 of a BALR or similar instruction on the return stack, which holds information specifying the return address, and R2 of a BCR or similar instruction which holds the branch destination address of a potential subroutine return instruction.

c) an identifying circuit identifying an instruction equivalent to a subroutine return, which corresponds to the instruction equivalent to the subroutine call, based on the result of the comparison. It is inherent in the system disclosed by Losq, that identifying circuitry must be present since Losq's system is able to identify an instruction equivalent to a subroutine return.

d) wherein the predicted branch is the branch of the instruction equivalent to the subroutine return in an architecture for which a particular instruction for a subroutine is not prepared (see page 2, lines 22-32).

6. Referring to claim 2, Losq has not explicitly taught a storing circuit which stores a register number of a link register, which is specified by the instruction equivalent to the subroutine call, as the information specifying the return address. However, it is inherent the return address stack (storing circuit) stores a register number of a link register specified by a

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BALR instruction (potentially an instruction equivalent to a subroutine call) due to the format of a BALR instruction (see IBM ESA/390 Principles of Operation, pages 7-14 – 7-15).

7. Referring to claim 3, Losq has taught said storing circuit stores the return address of the subroutine as the information specifying the return address (See page 1, lines 24-27 and page 2, lines 1-13).

8. Referring to claims 4 and 17, Losq has taught:

a) a stack circuit storing information specifying a return address of a subroutine (See page 1, lines 25-27 and page 2, lines 1-4).

b) a push circuit pushing the information specifying the return address onto said stack circuit, when an instruction equivalent to a subroutine call is detected (Page 1, lines 26-27 and page 2, lines 1-2 inherently show push circuitry exists to push information specifying a return address down onto the stack).

c) a comparing circuit making a comparison between information specifying a branch destination address of an instruction which can possibly be an instruction equivalent to a subroutine return and the information specifying the return address stored in a top entry of said stack circuit, and outputting a result of a comparison, when the instruction which can possibly be the instruction equivalent to the subroutine return is detected. As explained herein above, this is inherent.

d) an identifying circuit identifying an instruction equivalent to a subroutine return, which corresponds to the instruction equivalent to the subroutine call, based on the result of the comparison. As explained herein above, this is inherent.

e) wherein the predicted branch is the branch of the instruction equivalent to the subroutine return in an architecture for which a particular instruction for a subroutine is not prepared (see page 2, lines 22-32).

9. Referring to claim 5, Losq has taught:

a) said push circuit pushes a register number of a link register, which is specified by the instruction equivalent to the subroutine call, onto said stack circuit as the information specifying the return address. As explained herein above, this is inherent.

b) said comparing circuit makes a comparison between a register number of a branch destination address register, which is specified by the instruction which can possibly be the instruction equivalent to the subroutine return, and a register number stored in the top entry of said stack circuit. As explained herein above, this is inherent.

c) said identifying circuit identifies the instruction which can possibly be the instruction equivalent to the subroutine return as the instruction equivalent to the subroutine return when the compared register numbers match. As explained herein above, this is inherent.

10. Referring to claim 6, Losq has taught said identifying circuit identifies the instruction which can possibly be the instruction equivalent to the subroutine return as the instruction equivalent to the subroutine return regardless of the result of the comparison, if the register number of the branch destination address register corresponds to a particular register. Losq has taught that if a potential equivalent to a subroutine return corresponds to a particular register (see page 2, lines 2-8).

11. Referring to claim 7, Losq has taught said push circuit does not push the register number of the link register onto said stack circuit if the register number of the link register corresponds to

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a particular register. If the R2 field of BALR instruction corresponds to a particular register, 0, nothing is pushed onto the stack (ESA/390 Principles of Operation, page 7-15, Programming notes: 2.).

12. Referring to claim 8, Losq has taught a pop circuit popping said stack circuit when said identifying circuit identifies the instruction which can possibly be the instruction equivalent to the subroutine return as the instruction equivalent to the subroutine return, and a branch by the instruction equivalent to the subroutine return is taken (see page 2, lines 44-46 show that pop circuitry in the system of Losq is inherent).

13. Referring to claim 9, Losq has taught:

a) a predicting circuit storing branch history information for a branch prediction (Losq's system contains a branch history table in it's predicting circuitry to store branch history information), wherein

b) said comparing circuit makes the comparison between the information specifying the branch destination address and the information specifying the return address, when the branch history information is registered to said predicting circuit. A comparing circuit is inherent as explained herein above including when the branch history information is registered in the branch history table to said predicting circuit.

14. Referring to claim 10, Losq has taught a circuit invalidating the information stored in said storing circuit when an event which causes correspondence between a subroutine call and a subroutine return to be improper. A circuit invalidating information stored in said storing circuit is inherent since the return address stack is not popped when there is a improper correspondence between a subroutine call and return (see page 2, lines 44-47 and page 3, line 1).

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15. Referring to claim 11, Losq has taught:

- a) a predicting circuit storing branch history information for a branch prediction (as taught herein above);
- b) a setting circuit setting in said predicting circuit a flag indicating that a return destination of a detected instruction equivalent to a subroutine return differs, when an instruction equivalent to a subroutine return, which does not return to an instruction address immediately succeeding the instruction equivalent to the subroutine call, is detected. It is inherent the predicting circuit of Losq must use some type of flag to indicate that a return destination of potential subroutine return differs or the system would not function correctly.

16. Referring to claim 12, it is inherent the system disclosed by Losq has said predicting circuit comprises a return address stack circuit storing the return address of the subroutine, pops said return address stack circuit if the flag is recognized at the time of a branch prediction, and does not use a popped return address as a predicted branch destination. It is necessary to be able to pop a return address on a return address stack if a return address has to be removed but not used.

17. Referring to claim 13, Losq has taught:

- a) predicting circuit storing branch history information for a branch prediction (as explained herein above);
- b) a circuit performing a control such that a predetermined flag is set when an instruction equivalent to a subroutine call, which is unregistered to said predicting circuit, is detected, the predetermined flag is reset when an instruction equivalent to a subroutine return, which corresponds to the unregistered instruction equivalent to the subroutine call, is detected, and the

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instruction equivalent to the subroutine return corresponding to the unregistered instruction is not identified as an instruction equivalent to a subroutine return is said predicting circuit. It is inherent the system disclosed by Losq must be able to handle instruction equivalent to a subroutine calls not registered to said predicting circuit.

18. Referring to claims 14 and 18, Losq has taught

- a) a return address stack circuit storing a return address of a subroutine when an instruction equivalent to a subroutine call is detected (see page 1, lines 24-26);
- b) a comparing circuit making a comparison between a branch destination address of an instruction which can possibly be an instruction equivalent to a subroutine return, and the return address stored in said return address stack circuit, and outputting a result of the comparison, when the instruction which can possibly be the instruction equivalent to the subroutine return is detected. This is inherent as explained herein above.
- c) an identifying circuit identifying an instruction equivalent to a subroutine return, which corresponds to the instruction equivalent to the subroutine call, based on the result of the comparison. This is inherent as explained herein above.
- d) wherein the predicted branch is the branch of the instruction equivalent to the subroutine return in an architecture for which a particular instruction for a subroutine is not prepared (see page 2, lines 22-32).

19. Referring to claim 15, the method in claim 15 does not recite limitations above the claimed device set forth in the above claims and is therefore rejected for the same reasons set forth in the rejection of the above claims.

Response to Arguments

20. Applicant's arguments filed 06/24/03, paper number 6, have been fully considered but they are not persuasive.

21. In the Remarks, on page 8, Applicant argues in essence that:

"In particular, the invention is directed to a situation where the predicted branch is the "branch of the instruction equivalent to the subroutine return in an architecture for which a particular instruction for a for a subroutine is not prepared". Losq does not teach or suggest a solution to this problem solved in the present invention."

This argument has not been found persuasive because Losq does in fact teach on page 2, lines 22-32, one of the problems is to be able to detect when a branch implements a return from a subroutine. There is no special instruction(s) defined for this purpose. Therefore, it was found that the most common way to return a subroutine is through a BCR instruction. This would be an "instruction equivalent to the subroutine return".

22. In the Remarks, on page 8, Applicant argues in essence that:

"Further, the rejection is based on an assertion that Losq uses a decoder for address comparison... The rejection is traversed as based on an inadequate foundation."

This argument has not been found persuasive. A typographical mistake was made. Examiner should have written --BHT-- instead of "decoder". Additionally, page 2 of Losq, lines 40-46, as cited in the prior Office action clearly state, "When the BHT predicts a taken BCR, it will compare the register field R2 of the BCR..." showing that the BHT has comparing circuitry.

23. In the Remarks, on page 8-9, Applicant argues in essence that:

"That is, the first time that the instruction address is encountered, the comparing and identifying circuits of the present invention operate to identify an equivalent to a subroutine call and return. This allows the present invention all a reaction to occur when such a reaction would not occur in Losq"

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In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "the first time that the instruction address is encountered") are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

24. In the Remarks, on page 9, Applicant argues in essence that:

"As discussed above, Losq does not solve the problem or attain the result of the present invention. Thus, Losq does not inherently include the components of the present invention."

This argument has not been found persuasive. Examiner had previously stated that it is inherent that Losq must have identifying circuitry identifying an instruction equivalent to a subroutine return. As Losq has taught, the BHT circuitry compares the register field R2 of the BCR instruction (an "instruction equivalent to a subroutine return) with the register field R1 at the top of the stack. Before any comparisons can be made, there must be circuitry that enables the BHT to identify a BCR instruction apart from other instructions that are being processed or the BHT would not recognize a BCR as a potential instruction equivalent to a subroutine return and perform the comparison.

25. In the Remarks, on page 9, Applicant argues I essence that:

"The Examiner alleges that this (setting a flag) "must" exist in Losq. This is not the case, as noted Losq initiates a reset procedure when a return from a subroutine is to a different address."

This argument has not been found persuasive because it is inherent that a flag would be set in the system of Losq in order to initiate a reset.

Conclusion

26. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Justin Knapp whose telephone number is (703) 308-6132. The examiner can normally be reached on Mon - Fri 9 am - 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Gaffin can be reached on (703) 308-3301. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Justin Knapp
Examiner
Art Unit 2182


RICHARD L. ELLIS
PRIMARY EXAMINER

August 25, 2003